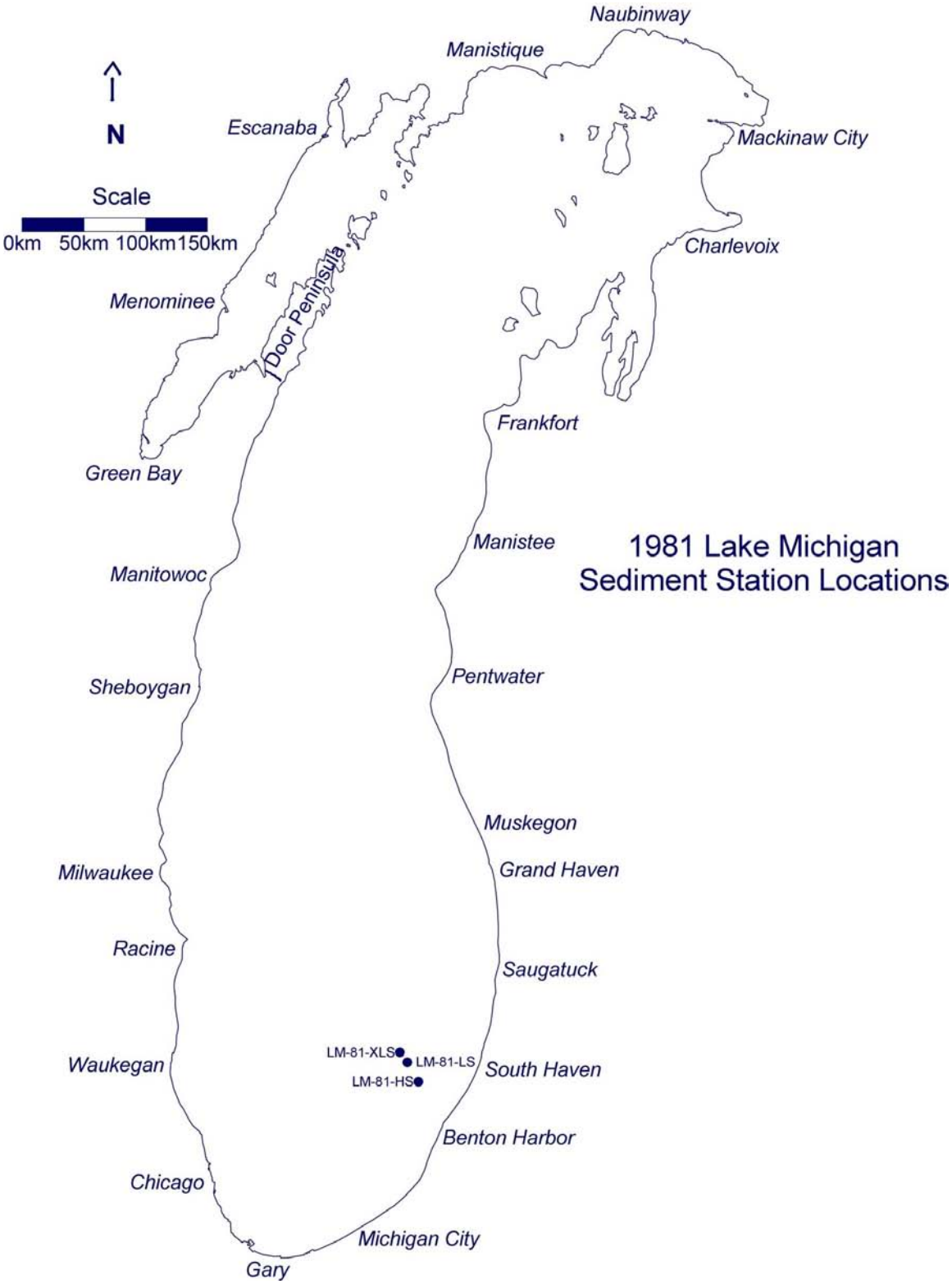
Figure 6-8. Station Locations for 1981 Sediment Cores



A general comparison of these results can be potentially misleading. It appears that mercury may be decreasing in surficial sediments between 1969 and 1996. The problem is derived from using grab samples that penetrated a variety of sediment depths and sampled a variety of sediment types. Samples reported by Cahill (1981) represented a homogenate of the surficial 3 cm. It is possible that collection to a depth of 3 cm penetrated to older sediments generally known to be more contaminated with mercury, skewing the results toward a higher concentration (Rossmann and Edgington, 2000). Also, samples collected in 1975 and 1994-1996 were representative of a variety of sediment types. Samples collected from sandy areas will skew the results toward lower mercury concentrations. Mercury is associated with fine-grained sediments. Depending upon the station distribution for a data set, results may be biased to various regions of the lake basin. Thus, a direct comparison of data set that have different station distributions and different depths of surficial sediment can lead to incorrect conclusions. To avoid these problems, it is best to compare only those sediments collected at the same sampling interval from the same station in a depositional basin.

There is only one location for which a direct comparison with historical data may be made. LMMB Station 15 (Figure 6-1) is coincident with Station K8 reported by Cahill (1975). It is within 5 km of Station 105 reported by Kennedy *et al*. (1971) and Station LM-81-HS reported by Pirrone *et al*. (1998). Two comparisons can be made. The first is a comparison for the surficial sample interval of 0 - 3 cm sediment depth, and the second is a comparison for the interval of 0 - 1 cm sediment depth. For the 0 - 3 cm surficial sediment depth interval, there is a distinct decrease in mercury concentration between 1969 and 1975 which continues through 1981 (Table 6-13).

Table 6-13. Comparison of Lake Michigan Results at Station 15 to Historical Results for the 0 - 3 cm Surficial Sediment Interval

Year Collected	Mercury Concentration (ng/g)	Reference and Surficial Interval Sampled
1969	300	Kennedy *et al*. (1971)
1975	240	Cahill (1975)
1981	180	Pirrone *et al*. (1998)

This decrease is also evident for the 0 - 1 cm surficial sediment depth interval comparison (Table 6-14). Thus, there has been a decrease in mercury concentrations in surficial sediments between 1969 and 1994. The decrease between 1969 and 1975 was at the rate of 4.3 ng/cm^2/y and that between 1975 and 1981 was 10 ng/cm^2/y. The resolution for these 0 - 3 cm of surficial sediments was roughly 5 years. A more realistic recent rate of mercury decline is derived from the 0 - 1 cm results, where the resolution is less than one year. The most recent rate of decrease between 1981 and 1994 was 3.8 ng/cm^2/y.

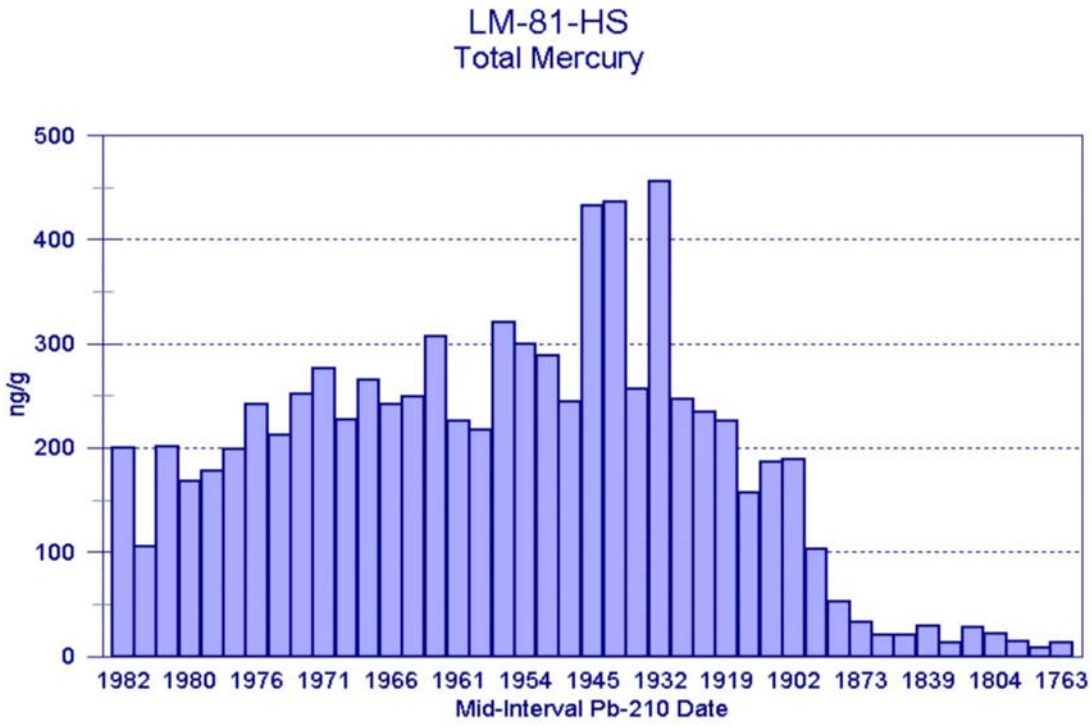
Table 6-14. Comparison of Lake Michigan Results at Station 15 to Historical Results for the 0 - 1 cm Surficial Sediment Interval

Year Collected	Mercury Concentration (ng/g)	Reference and Surficial Interval Sampled
1981	150	Pirrone *et al*. (1998)
1994	100	This study

The recent decrease in mercury concentrations in surficial sediments is corroborated by results for the 1981 core that are reported by Pirrone *et al*. (1998) and presented in a slightly different manner here (Figure 6-9). At this station, pre-1800 background mercury concentrations ranged between 8 and 14 ng/g. Between 1930 and 1950, peak mercury concentrations as high as 460 ng/g were reached. By the late 1950s, mercury reached its maximum concentration ranging between 300 and 450 ng/g. After 1970,

mercury concentrations began to decrease. The decrease that was noted in the 1981 core has continued through 1994 at this location in the lake.

Figure 6-9. Vertical Variation of Mercury in Core LM-81-HS



Each bar represents one interval of the core.

6.4.3 Comparison to Historical Lake Michigan Horizontal Variations

Horizontal variations of mercury in surficial sediments can be compared to two previously published data sets. As discussed in the previous section, absolute concentrations cannot be compared; however, patterns of variation can be discussed. The Kennedy *et al*. (1971) data set for the period of 1969-1970 covers southern Lake Michigan (Figure 6-6). The distribution pattern (Figure 6-10) is similar to that for 1994-1996 (Figure 6-3) and mimics the bottom topography (Figure 6-4). The same is true for the Cahill (1981) data set collected in 1975 (Figure 6-11). The 1975 data set is very extensive and includes stations from the entire lake (Figure 6-7). These two data sets and the current one produce mercury distribution patterns that are similar and conform to the lake's bathymetry, sediment and mercury sources, and water circulation pattern.